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Pygmy grasshoppers (Orthoptera, Tetrigidae) of Kole wetlands, a Ramsar site in Kerala, India

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Abstract

The Kole wetlands of Kerala is a unique wetland ecosystem, a designated Ramsar site and a high-value biodiversity area, yet its insect fauna has not been thoroughly studied. Tetrigidae (pygmy grasshoppers) are a taxonomically complicated group under Orthoptera, which is not well explored in Kerala. The present survey was conducted in the Kole wetlands of Kerala from January 2021 to January 2024 and found 12 morphospecies under 8 genera. Genera *Tetrix* and *Thoradonta* were reported for the first time from the state. A generic level key for the identification of pygmy grasshoppers of the Kole wetlands is provided.

Keywords

Conservation, faunistics, groundhoppers, Indian fauna, insect ecology, species list, taxonomic survey, wetland biodiversity

Introduction

Tetrigidae, also known as pygmy grasshoppers, is the only family under Tetrigoidea. It is the second largest grasshopper family, with 2037 valid species across the world (Cigliano et al. 2025); among these, 165 species have been reported from India (Chand et al. 2024) and 22 species from Kerala (Thasnim et al. 2023).

Tetrigidae can be easily identified by the prolonged pronotum over the abdomen, lack of arolium, two-segmented first and second tarsi, and three-segmented third tarsi (Tumbrinck 2014). Their small size, inconspicuous appearance, cryptic coloration, and lack of perceptible sound production make them one of the least studied groups under Orthoptera; thus, their taxonomy, ecology, and ethology are little known (Hochkirch et al. 2000, Adžić et al. 2022), and the taxonomy remains problematic as many species have been poorly demarcated and wrongly classified (Tumbrinck 2014, Skejo and Gupta 2015, Lehmann et al. 2017, Long et al. 2023, Kasalo et al. 2023, 2025).

Tetrigidae species are distributed on all continents, inhabit almost all climatic zones (Tumbrinck and Skejo 2017), and are often connected with aquatic and semi-aquatic habitats. While most are limno-terrestrial, some are water-dependent and adapted for swimming, diving, and even resting underwater (Amédégnato and Devriese 2008, Adžic et al. 2022, Rebrina et al. 2025). They are detrito-bryophagous, as they feed on mosses and detritus as well as algae, diatoms, lichens, and liverworts (Hochkirch et al. 2000; Kuřavová et al. 2020).

Because of the limited number of studies on the pygmy grasshoppers of Kerala (Bhaskar et al. 2019, 2020, Mathew et al. 2022), there remains a significant gap in understanding its distribution and ecology in this region. Even though they are considered semi-aquatic (Song 2019, Amédégnato and Devriese 2008, Adžic et al. 2022, Rebrina et al. 2025), few studies on pygmy grasshoppers have focused on the wetland ecosystems of Kerala.

The wetlands in Kerala face significant pressure due to rapid development and indiscriminate land and water use (Kokkal et al. 2008). The Kole wetlands are a unique, biodiversity-rich and threatened wetland ecosystem that is part of Vembanad Kole, a Ramsar site in Kerala (Islam and Rahmani 2008). Kole Wetland has been designated as an Important Bird Area (IBA) since 2004 (Islam and Rahmani 2004) and a high-value biodiversity area since 2009 (MoEF 2009). However, little attention has been given to the insect fauna of the Kole wetlands, especially the grasshopper species present there. Thus, this is the first attempt to document the pygmy grasshoppers of the Kole Wetlands.

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Materials and methods

The Kole wetlands are low-lying tracts located 0.5–1 m below the mean sea level. They span two districts in Kerala—Thrissur and Malappuram—and cover 13,632 ha (Johnkutty and Venugopal 1993). The ecosystem remains submerged under flood water for about six months a year, and this seasonal alteration gives it both terrestrial and water-related properties (Srinivasan 2010).

Pygmy grasshoppers were collected from selected areas of the Kole wetlands of both districts from February 2021 to January 2024 using a sweep net and hand picking. Collected specimens were killed with fumes of ethyl acetate, preserved by pinning, and deposited in the insect collection of the Shadpada Entomology Research Lab (SERL), Christ College, Irinjalakuda, Thrissur, Kerala. Specimens were examined under a Labomed Luxeo 6Z Stereomicroscope and photographed using a Canon 7D Mark II digital camera with a 100 mm F/2.8L macro lens and a Leica M205 Stereomicroscope with LAS V3.7 software. Taxonomy follows the latest version of the Orthoptera Species File (Cigliano et al. 2025). Specimens were identified using original descriptions and other taxonomic literature (Bolívar 1887, Hancock 1909, Kirby 1914, Hancock 1915, Shishodia 1991a, Zheng et al. 2012, Skejo and Gupta 2015, Storozhenko et al. 2015, Gupta et al. 2016, Gupta 2016a, b, Zha et al. 2016, Gupta and Chandra 2017, 2018, Tumbrinck 2018, Deng et al. 2019, Tumbrinck 2019, Lu and Zha 2020, Deng 2021, Subedi 2022) and comparisons with type photographs provided in the Orthoptera Species File (Cigliano et al. 2025). In cases where no specific diagnostic characters for certain genera were available, morphological characters described in previous works were used as the primary references for provisional identification. Further revisionary works are needed to resolve these taxonomic uncertainties.

Results

A total of 162 individuals belonging to 12 morphospecies under 8 genera were collected from different areas of the Kole wetlands of Kerala.

Key to the Tetrigid genera of Kole wetlands of Kerala

1 Lateral lobe of pronotum with spine **2**
– Lateral lobe of pronotum without spine **4**
2 External lateral carinae of pronotum bent upwards behind humeral angles in lateral view, curved inwards in dorsal view ..... *Thoradonta* **Hancock, 1909**
– External lateral carinae of pronotum do not bend and not curved inwards **3**
3 Head above pronotum level, vertex as wide as an eye or narrower .... *Eucriotettix* **Hebard, 1930 and** *Criotettix* **Bolívar, 1887 (in need of revision, currently inseparable)**
– Head in pronotum level, vertex wider than an eye ..... *Acanthalobus* **Hancock, 1904**
4 Vertex and eyes raised above pronotum level **5**
– Vertex and eyes in pronotum level **6**
5 Antennae inserted below middle of compound eyes in frontal view; medium carinae of pronotum not undulated ..... *Euparatettix* **Hancock, 1904**
– Antennae inserted distinctly below inferior margin of compound eyes in frontal view; median carina of pronotum undulated ..... *Ergatettix* **Kirby, 1914**
6 Disc of pronotum smooth; median carina continuous; prozonal carinae parallel; mid femora slightly widened **7**
– Disc of pronotum tuberculated; median carina usually interrupted; prozonal carinae converging. Mid femora not widened ..... *Coptotettix* **Bolívar, 1887**
7 Median carina of pronotum elevated; frontal costa concave between lateral ocelli ..... *Tetrix* **Latreille, 1802**
– Median carina of pronotum not elevated; frontal costa in lateral view L-shaped ..... *Hedotettix* **Hancock, 1904**

Taxonomic account

Family Tetrigidae Rambur, 1838

Genus *Coptotettix* Bolívar, 1887

Synonym.— *Copotettix* Mahmood, Idris & Salmah, 2007.

Type species.—*Coptotettix asperatus* Bolívar, 1887, by subsequent designation.

Taxonomic remarks.—Vertex not produced in front of eyes in profile, head not raised above pronotum level; body wrinkled/granular/tubercular, vertex narrower anteriorly, frontal ridge rounded in profile, antennae inserted to lower margin of compound eyes, median carina of pronotum interrupted; prozonal carinae converging posteriorly, inter-humeral carinae present.

Composition.—The genus includes 71 valid species worldwide (Cigliano et al. 2025). Of these, 16 are reported from India (Chand et al. 2024), and a single species is reported from Kerala (Thasnim et al. 2023).

Based purely on the general appearance, the specimens collected from the Kole wetlands may be tentatively grouped into at least two morphospecies of *Coptotettix*.

Coptotettix sp. 1
Fig. 1A, B

Materials examined.—INDIA • 1♀; Kerala, Malappuram, Srayilkadavu; 10.70082°N, 76.02652°E; 17 Nov. 2022; Thasnim E.S. leg.; CCSERLOSNFNII13 • 1♂, 3♀; Kerala, Thrissur; Jubilee Thevarpadavu; 10.42243°N, 76.18025°E; 15 Sep. 2021; Thasnim E.S. leg.; CCSERLOJSFNI1, CCSERLOJSFNI7, CCSERLOJSFNI10, CCSERLOJSFNI11 • 1♀; same collection data as for preceding; 10 Jan. 2022; CCSERLOJJrFNI2.

Remarks.—Disc of pronotum strongly rugose, median carina interrupted strongly. Length of pronotum varies.

Coptotettix sp. 2
Fig. 1C–H

Materials examined.—INDIA • 1♂; Kerala, Thrissur, Jubilee Thevarpadavu; 10.42243°N, 76.18025°E; 15 Sep. 2021; Thasnim E.S. leg.; CCSERLOJSFNI9 • 1♂; same collection data as for preceding; 1 Aug. 2022; CCSERLOJAuFNII4 • 1♀; same collection data as for preceding; 2 Nov. 2022; CCSERLOJNANII23.

Remarks.—Disc of pronotum not as strongly rugose as that of *Coptotettix* sp. 1, median carinae interrupted only between humeral carinae. Length of pronotum varies.

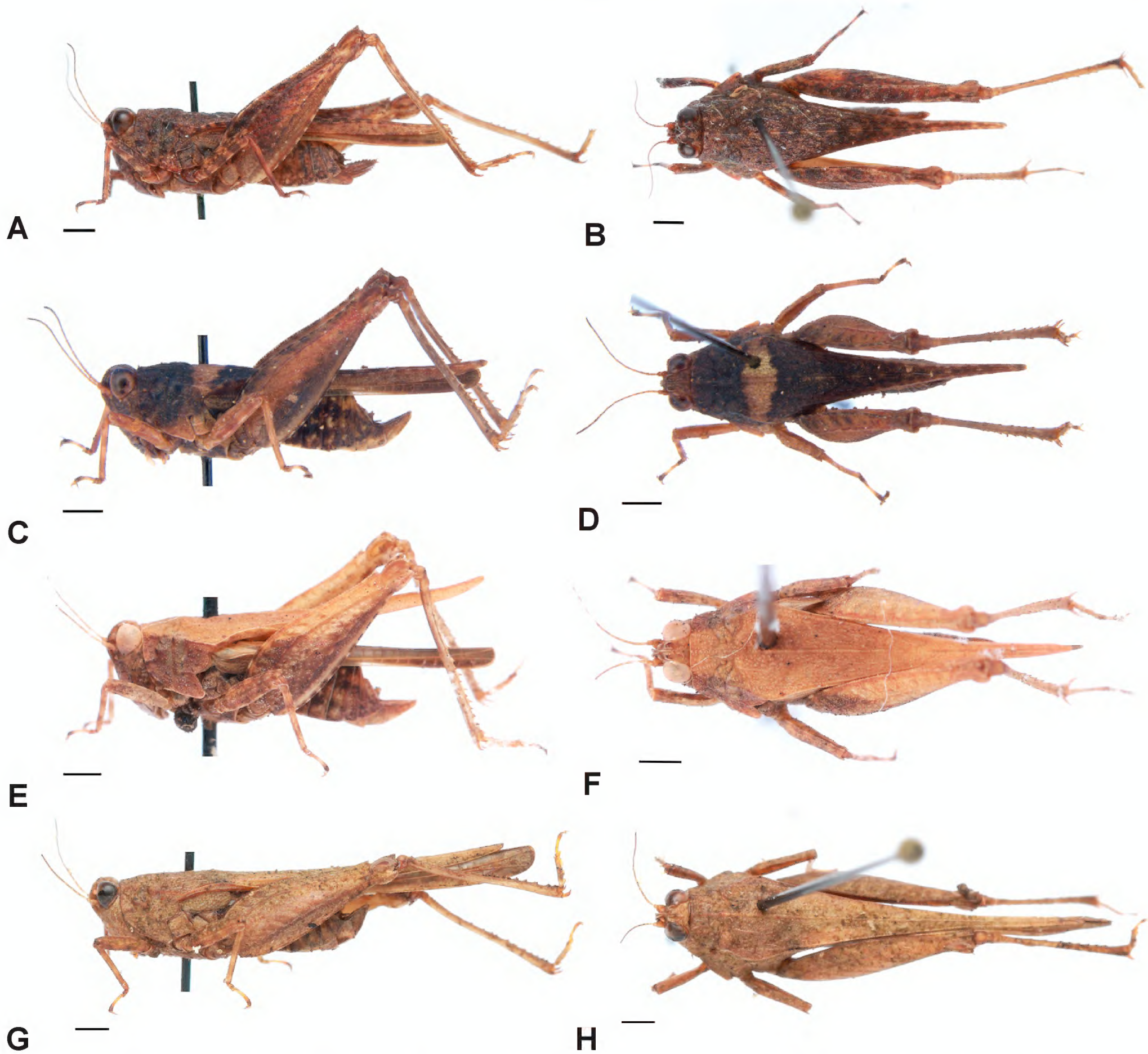

Fig. 1. Genus *Coptotettix* **A.** *Coptotettix* sp. 1, lateral view; **B.** *Coptotettix* sp. 1, dorsal view; **C.** *Coptotettix* sp. 2, morph 1, lateral view; **D.** *Coptotettix* sp. 2, morph 1, dorsal view; **E.** *Coptotettix* sp. 2, morph 2, lateral view; **F.** *Coptotettix* sp. 2, morph 2, dorsal view; **G.** *Coptotettix* sp. 2, morph 3, lateral view; **H.** *Coptotettix* sp. 2, morph 3, dorsal view. Scale bars: 1 mm.

Criotettiginae Kevan, 1966
Tribe Criotettigini Kevan, 1966

Genus *Criotettix* Bolívar, 1887

Synonym.—*Acanthalobus* Hancock, 1904.
Acantholobus Hancock, 1904.

Type species.—*Acrydium bispinosum* Dalman, 1818 (= *Criotettix bispinosus*), by subsequent designation.

Taxonomic remarks.—Very similar to genus *Eucriotettix* but differ in head not exerted above pronotum level. Vertex wider or equal to width of compound eyes. Ventro-lateral projection of pronotum spine-like.

Composition.—Includes 54 species worldwide (Cigliano et al. 2025). Nine species were reported in India (Chand et al. 2024) and a single species from Kerala (Thasnim et al. 2023).

Based on morphological differences, the specimens collected were tentatively grouped into two morphospecies.

Criotettix sp. 1
Fig. 2C, D

Materials examined.—INDIA • 1♀; Kerala, Thrissur, Thommana; 10.34418°N, 76.25545°E; 29 Jul. 2022; Thasnim E.S. leg.; CCSERLOTJlFNII2 • 1♂, 1♀; same collection data as for preceding; 27 Oct. 2021; CCSERLOTOFNI1, CCSERLOTOANI5 • 1♀; same collection data as for preceding; 9 Aug. 2021; CCSERLOTAuFNI10 • 1♀; Kerala, Thrissur, Jubilee Thevarpadavu; 10.422433°N,

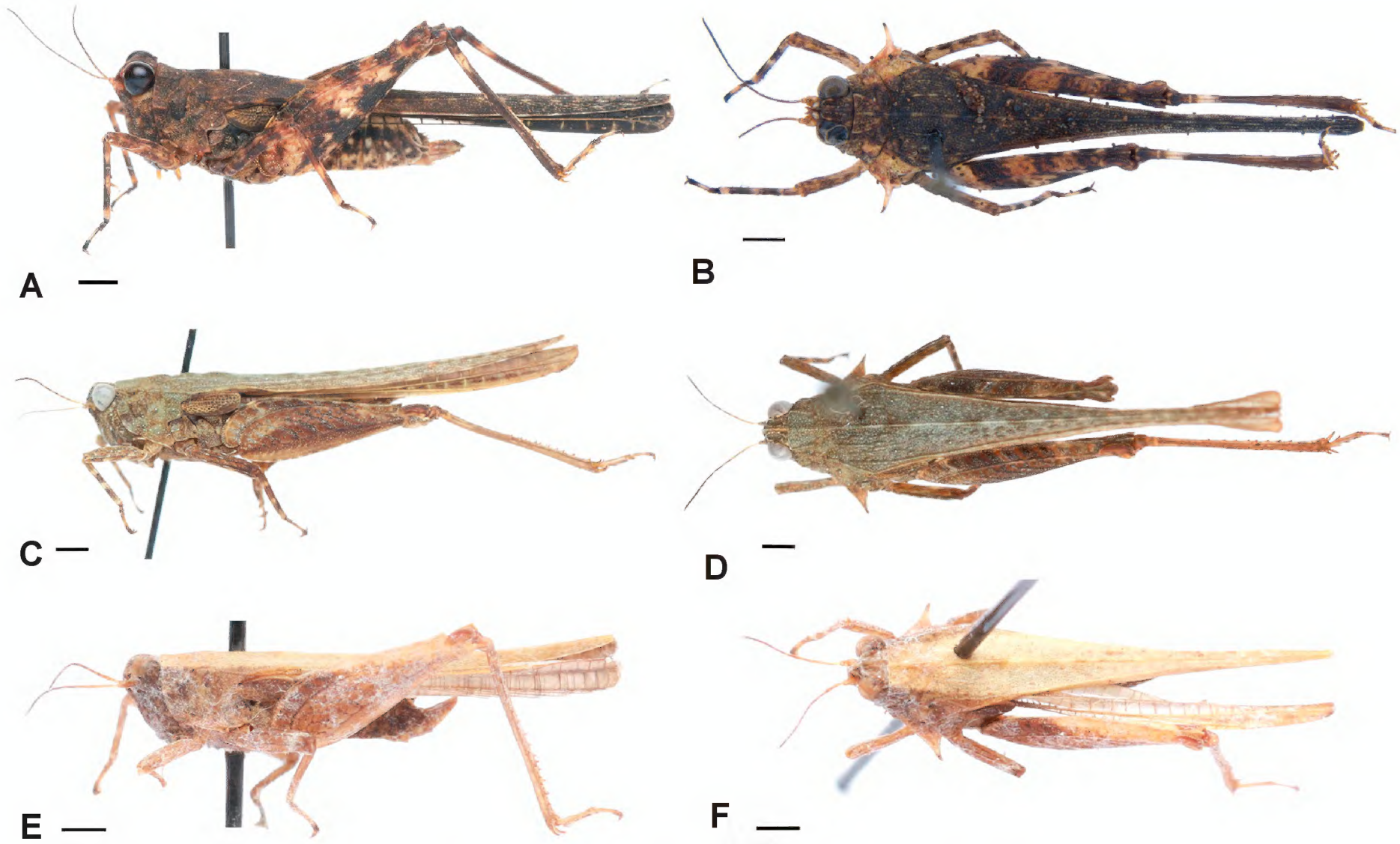

Fig. 2. Genus *Criotettix* and *Eucriotettix*. A. *Eucriotettix spinilobus*, lateral view; B. *Eucriotettix spinilobus*, dorsal view; C. *Criotettix* sp. 1, lateral view; D. *Criotettix* sp. 1, dorsal view; E. *Criotettix* sp. 2, lateral view; F. *Criotettix* sp. 2, dorsal view. Scale bars: 1 mm.

76.18025°E; 15 Sep. 2021; Thasnim E.S. leg.; CCSERLOJSFNI5 • 1♀; same collection data as for preceding; 15 Sep. 2021; CCSERLOJSFNIII4 • 2♀; Kerala, Thrissur, Konthipulam; 10.38566°N, 76.23761°E; 4 Sep. 2021; CCSERLOKSFNI4, CCSERLOKSNI11 • 1♀; Kerala, Thrissur, Palakkal; 10.47874°N, 76.21322°E; 23 Apr. 2021; Thasnim E.S. leg.; CCSERLOPAFNI2 • 1♀; Kerala, Malappuram, Srayilkadavu; 10.70082°N, 76.02652°E; 9 Jul. 2021; CCSERLOSJlFNI11 • 1♂, 1♀; same collection data as for preceding; 7 Sep. 2021; CCSERLOSSFNI4, CCSERLOSSANI12 • 1♀; Kerala, Malappuram, Uppungalkadavu; 10.69113°N, 76.00338°E; 8 Jan. 2021; Thasnim E.S. leg.; CCSERLOUJrANI9 • 1♀; same collection data as for preceding; 16 May 2021; CCSERLOUMyFNII3 • 1♂, 1♀; same collection data as for preceding; 7 Aug. 2021; CCSERLOUAuANI10.

Remarks.—Similar to *Criotettix* sp. 2, but different in median carinae interrupted between humeral carinae, pronotum more tuberculated.

Criotettix sp. 2
Fig. 2E, F

Materials examined.—INDIA • 1♂; Kerala, Thrissur, Konthipulam; 10.38566°N, 76.23761°E; 4 Sep. 2021; Thasnim E.S. leg.; CCSERLOKSFNI9 • 1♀; Kerala, Thrissur, Jubilee Thevarpadavu; 10.42243°N, 76.18025°E; 15 Sep. 2021; Thasnim E.S. leg.; CCSERLOJSANI28 • 1♂; Kerala, Malappuram, Uppungalkadavu; 10.69113°N, 76.00338°E; 7 Aug. 2021; Thasnim E.S. leg.; CCSERLOUAuFNI6 • 1♀; Kerala, Malappuram, Srayilkadavu; 10.70082°N, 76.02652°E; 7 Sep. 2021; CCSERLOSSANI11.

Remarks.—Different from *Criotettix* sp. 1 in having continuous median carinae and less tuberculated disc of pronotum.

Tribe Thoradontini Kevan, 1966

Genus *Eucriotettix* Hebard, 1930

Synonyms.—*Systolotettix* Hebard, 1930

Type species.—*Criotettix tricarinatus* Bolívar, 1887, by original designation.

Taxonomic remarks.—It is similar to *Criotettix* but differs in having the head exserted above upper level of pronotum. Ventro-lateral projection of lateral lobe of pronotum appears as long spine. Vertex narrower than width of compound eyes.

Composition.—The genus includes 38 valid species (Cigliano et al. 2025), 14 of which are reported from India (Chand et al. 2024); among these, 3 are reported from Kerala (Thasnim et al. 2023). Only one species from Kole wetlands was encountered during this study.

Eucriotettix spinilobus (Hancock, 1904)
Fig. 2A, B

Materials examined.—INDIA • 5♂, 10♀; Kerala, Thrissur, Jubilee Thevarpadavu; 10.42243°N, 76.18025°E; 2 Nov. 2022; Thasnim E.S. leg.; CCSERLOJNFNII1 to CCSERLOJNFNII5, CCSERLOJNNII11 to CCSERLOJNNII13, CCSERLOJNANII15 to CCSERLOJNANII21 • 1♀; Kerala, Malappuram, Srayilkadavu; 10.70082°N, 76.02652°E; 9 Jul. 2021; Thasnim E.S. leg.; CCSERLOSJlFNI1 • 1♀; Kerala, Malappuram, Uppungalkadavu; 10.69113°N, 76.00338°E; 22 Dec. 2023; Thasnim E.S. leg.; CCSERLOUDFNIII1.

Remarks.—Lateral spine of the pronotum is distinctly curved forward, frontal costa prominent between antennae.

Genus *Thoradonta* Hancock, 1909

Synonyms.— Thorodonta Steinmann, 1962.
Thoradonota Kevan, 1966.
Thorandota Otte, 1979.
Thoradonata Otte, 1997.
Thorodonota Mahmood, Maqsood & Anwar, 2004.
Thoradomta Deng, 2016.

Type species.—Thoradonta dentata Hancock, 1909 type species by original designation of *Thoradonta* Hancock, 1909

Taxonomic remarks.—The genus is characterized by external lateral carina being bent upwards behind humeral angles, appearing to be curved inwards. Ventro-lateral projections of pronotum appear as spines.

Composition.—This genus includes 19 valid species worldwide (Cigliano et al. 2025); of these, 6 species are reported from India (Chand et al. 2024). The genus has not been reported from Kerala before now (Thasnim et al. 2023).

Thoradonta spiculoba Hancock, 1912
Fig. 3A–F

Materials examined.—INDIA • 1♀; Kerala, Thrissur, Jubilee Thevarpadavu; 10.42243°N, 76.18025°E; 01 Aug. 2022; Thasnim E.S. leg.; CCSERLOJAuFNII6 • 1♂, 1♀; same collection data as for preceding; 15 Sep. 2021; CCSERLOJSFNI6, CCSERLOJSNI16 • 1♀; same collection data as for preceding; 2 Nov. 2022; CCSERLOJNNII14 • 1♂; same collection data as for preceding; 10 Dec. 2021; CCSERLOJDNI8 • 1♂; Kerala, Thrissur, Palakkal; 10.47872°N, 76.21322°E; 6 Nov. 2021; Thasnim E.S. leg.; CCSERLOPNFNI3 • 1♂; Kerala, Thrissur, Thommana; 10.34418°N, 76.25545°E; 09 Aug. 2021; Thasnim E.S. leg.; CCSERLOTAuFNI9 • 2♂, 1♀; Kerala Malappuram, Uppungalkadavu; 10.69113°N, 76.003383°E; 25 Aug. 2022; Thasnim E.S. leg.; CCSERLOUAuFNII5, CCSERLOUAuFNII6, CCSERLOUAuANII10 • 1♂; same collection data as for preceding; 27 May 2023; CCSERLOUMyFNIII3 • 1♀ ; same collection data as for preceding; 23 Feb. 2021; CCSERLOUFFNI7 • 1♂; Kerala, Malappuram, Srayilkadavu; 10.70082°N, 76.02652°E; 9 Jul. 2021; Thasnim E.S. leg.; CCSERLOSJlFNI7 • 1♂; same collection data as for preceding;

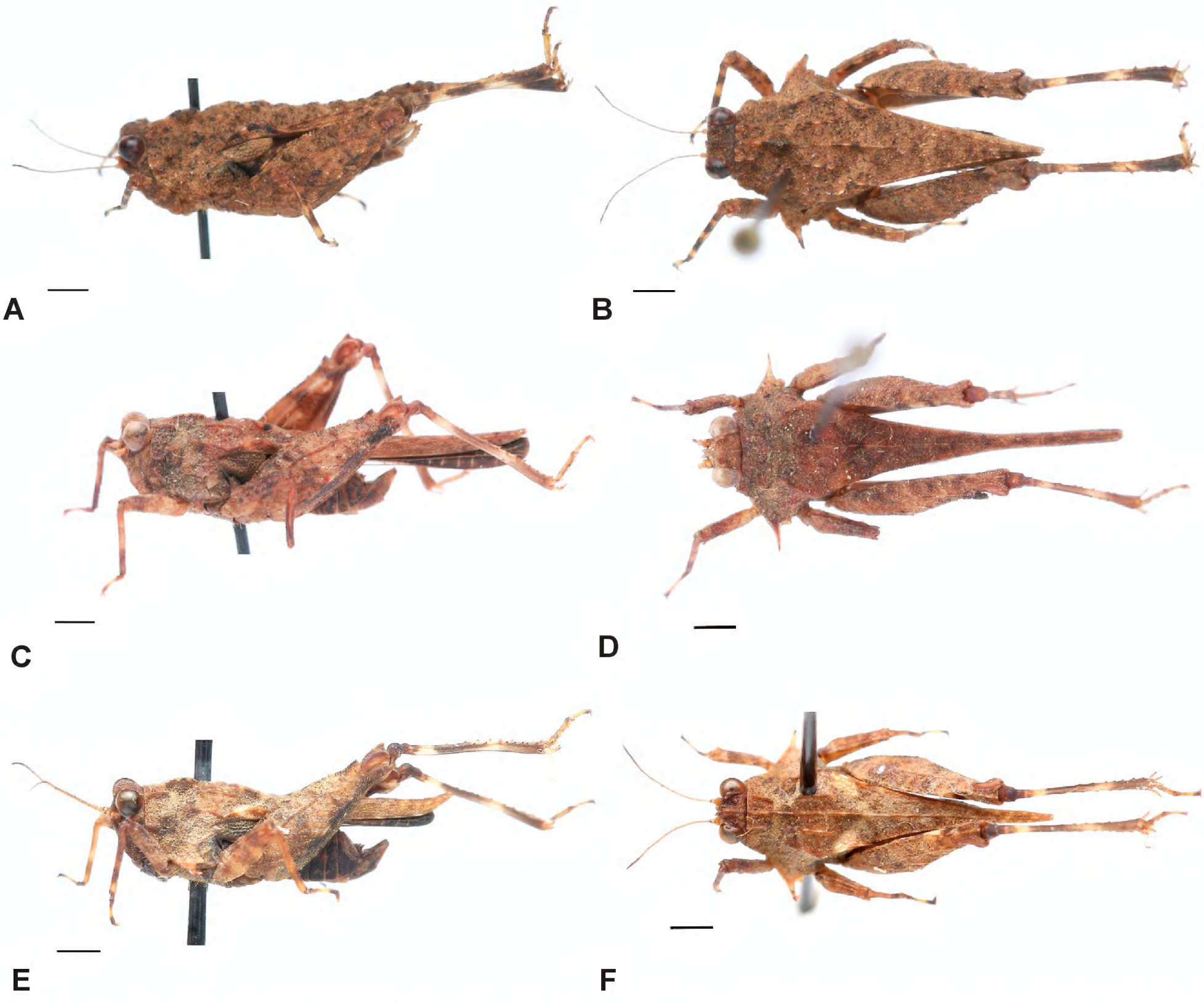

Fig. 3. *Thoradonta spiculoba* **A.** *Thoradonta spiculoba*, morph 1, lateral view; **B.** *Thoradonta spiculoba*, morph 1, dorsal view; **C.** *Thoradonta spiculoba*, morph 2, lateral view; **D.** *Thoradonta spiculoba*, morph 2, dorsal view; **E.** *Thoradonta spiculoba*, morph 3, lateral view; **F.** *Thoradonta spiculoba*, morph 3, dorsal view. Scale bars: 1 mm.

17 Dec. 2021; CCSERLOSDANI14 • 1♂; same collection data as for preceding; 17 Nov. 2022; CCSERLOSNANII20.

Remarks.—Ventro-lateral projection long and transverse, length of pronotum varying, vertex wider than width of eye.

Subfamily Tetriginae Rambur, 1838

Genus *Ergatettix* Kirby, 1914

Type species.—*Ergatettix tarsalis* Kirby, 1914 (= *dorsiferus*), by monotypy and original designation

Taxonomic remarks.—Vertex and eyes raised above pronotum level; antennae inserted distinctly below inferior margin of compound eyes; median carina of pronotum undulated, mid femora wide, basal part of mid tibia expanded. Similar to *Euparatettix* but differs in antennal position, median carina, and width of mid-femora.

Composition.—Includes 19 valid species worldwide (Cigliano et al. 2025), 5 of which are reported in India (Chand et al. 2024) and a single species from Kerala (Thasnim et al. 2023).

Ergatettix dorsiferus **(Walker, 1871)**
Fig. 4A–F

Materials examined.—INDIA • 1♂; Kerala, Thrissur, Palakkal; 10.47874°N, 76.21322°E; 6 Jul. 2021; CCSERLOPNFNI2 • 3♂, 5♀; Kerala, Thrissur, Jubilee Thevarpadavu; 10.42243°N, 76.18025°E; 15 Sep. 2021; Thasnim E.S. leg.; CCSERLOJSFNI3, CCSERLOJSFNI4, CCSERLOJSFNI12, CCSERLOJSNI18, CCSERLOJSN20, CCSERLOJSANI22, CCSERLOJSANI24, CCSERLOJSANI29 • 2♂, 1♀; same collection data as for preceding; 23 Jul. 2021; CCSERLOJJlFNI2, CCSERLOJJlFNI5, CCSERLOJJlANI12 • 1♀; same collection data as for preceding; 2 Nov. 2022; CCSERLOJNFNII6 • 3♂; same collection data as for preceding; 10 Jun. 2023; CCSERLOJJnFNIII1, CCSERLOJJnFNIII2, CCSERLOJJnFNIII3 • 1♂, 2♀; Kerala, Malappuram, Uppungalkadavu; 10.69113°N, 76.00338°E; 13 Dec. 2021; Thasnim E.S. leg.; CCSERLOUDFNI7 to CCSERLOUDFNI9 • 2♂, 3♀; same collection data as for preceding; 8 Jan. 2022; CCSERLOUJrFNI1, CCSERLOUJrNI4 to CCSERLOUJrNI6, CCSERLOUJrNI8 • 1♂, 2♀; same collection data as for preceding; 25 Aug. 2022; CCSERLOUAuANII11, CCSERLOUAuANII12, CCSERLOUAuFNII8 • 4♂, 3♀; same collection data as for preceding; 22 Dec. 2023; CCSERLOUDFNIII2 to CCSERLOUDFNIII8 • 1♀; Kerala, Malappuram, Srayilkadavu; 10.70082°N, 76.02652°E; 9 Jul. 2021; Thasnim E.S. leg.; CCSER-

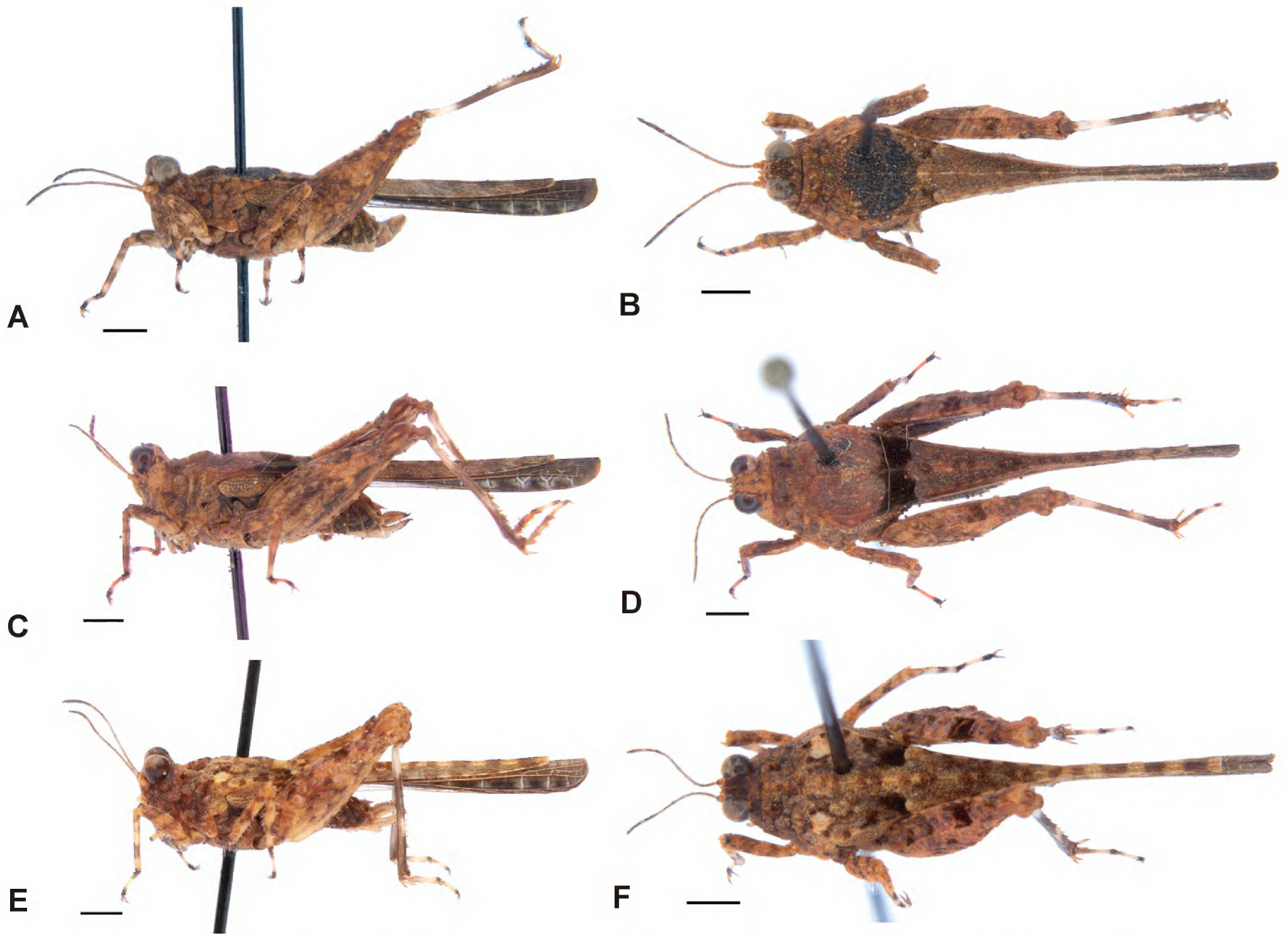

Fig. 4. *Ergatettix dorsiferus* **A.** *Ergatettix dorsiferus*, morph 1, lateral view; **B.** *Ergatettix dorsiferus*, morph 1, dorsal view; **C.** *Ergatettix dorsiferus,* morph 2, lateral view; **D.** *Ergatettix dorsiferus,* morph 2, dorsal view; **E.** *Ergatettix dorsiferus*, morph 3, lateral view; **F.** *Ergatettix dorsiferus,* morph 3, dorsal view. Scale bars: 1 mm.

LOSJlFNI5 • 1♀; same collection data as for preceding; 17 Dec. 2021; CCSERLOSDFNI3 • 3♂, 5♀; same collection data as for preceding; 17 Nov. 2022; CCSERLOSNFNII3 to CCSERLOSNFNII8, CCSERLOSNFNII10, CCSERLOSNFNII15.

Remarks.—Observed two morphs, which have variations in the shape of post-humeral spots.

Tribe Tetrigini Rambur, 1838

Genus *Euparatettix* Hancock, 1904

Synonyms.— *Indatettix* Hancock, 1915.
Euparatettixoides Zheng, 1994.

Type species.—*Paratettix personatus* Bolívar, 1887, by subsequent designation

Taxonomic remarks.—Vertex not produced in front of eyes; vertex and eyes raised above pronotum level; antennae inserted below middle of compound eyes; medium carinae of pronotum not undulated; mid-femora not wide compared to *Ergatettix*.

Composition.—The genus includes 71 valid species worldwide (Cigliano et al. 2025), eight of which are recorded from India (Chand et al. 2024) and a single species from Kerala (Thasnim et al. 2023).

Euparatettix personatus **(Bolívar, 1887)**
Fig. 5A–F

Material examined.—INDIA • 1♀; Kerala, Thrissur, Jubilee Thevarpadavu; 10.42243°N, 76.18025°E; 23 Jul. 2021; Thasnim E.S. leg.; CCSERLOJJlFNI6 • 3♂, 4♀; same collection data as for preceding; 15 Sep. 2021; CCSERLOJSFNI2, CCSERLOJSFNI13, CCSERLOJSNI17, CCSERLOJSANI23, CCSERLOJSANI25, CCSERLOJSANI26, CCSERLOJSANI27 • 1♂; same collection data as for preceding; 2 Nov. 2022; CCSERLOJNANII22 • 4♀; same collection data as for preceding; 10 Jun. 2023; CCSERLOJJnFNIII4, CCSERLOJJnFNIII5, CCSERLOJJnNIII6, CCSERLOJJnANIII7 • 3♂; same collection data as for preceding; 15 Sep. 2023; CCSERLOJSNIII6, CCSERLOJSANIII7, CCSERLOJSANIII8 • 3♂; Kerala, Thrissur, Konthipulam; 10.38566°N, 76.23761°E; 4 Sep. 2021; Thasnim E.S. leg.; CCSERLOKSFNI2, CCSERLOKSANI12, CCSERLOKSANI13 • 2♂; same collection data as for preceding; 12 Sep. 2023; CCSERLOKSFNIII8, CCSERLOKSANIII25 • 1♀; Kerala, Thrissur, Palakkal; 10.47874°N, 76.21322°E; 26 Sep. 2023; CCSERLOPSFNIII1 • 1♀; Kerala, Malappuram, Srayilkadavu; 10.70082°N, 76.02652°E; 17 Dec. 2021; Thasnim E.S. leg.; CCSERLOSDFNI6 • 5♂, 1♀; same collection data as for preceding; 17 Nov. 2022; CCSERLOSNFNII1, CCSERLOSNFNII2, CCSERLOSNFNII16, CCSERLOSNFNII17, CCSERLOSNFNII9, CCSERLOSNANII22 • 1♂; Kerala, Malappuram, Uppungalkadavu; 10.69113°N, 76.00338°E; 8 Jan. 2022; Thasnim E.S. leg.; CCSERLOUJrFNI2 • 2♂, 1♀; same collection data as for preceding; 25 Aug. 2022; CCSERLOUAuFNII2 to CCSERLOUAuFNII4.

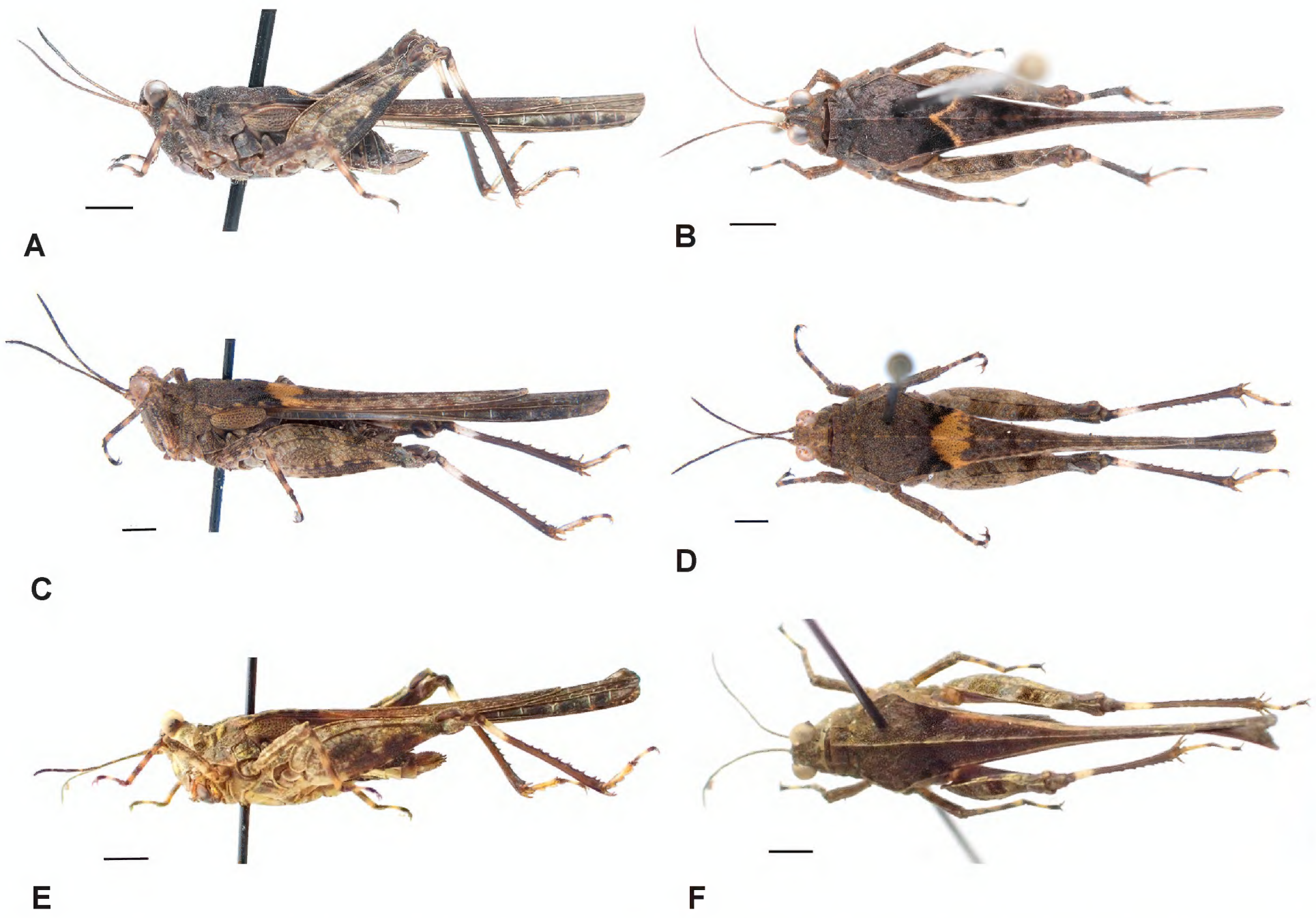

Fig. 5. *Euparatettix personatus* **A.** *Euparatettix personatus,* morph 1, lateral view; **B.** *Euparatettix personatus*, morph 1, dorsal view; **C.** *Euparatettix personatus,* morph 2, lateral view; **D.** *Euparatettix personatus,* morph 2, dorsal view; **E.** *Euparatettix personatus*, morph 3, lateral view; **F.** *Euparatettix personatus,* morph 3, dorsal view. Scale bars: 1 mm.

Remarks.—Short prozona, long antennae, white band on hind tibia. Exhibit variation in size, color and pattern near post-humeral spots.

Genus *Hedotettix* Bolívar, 1887

Type species.—*Acridium gracile* Haan, 1843 (= *Hedotettix gracilis*), by subsequent designation

Taxonomic remarks.—Head not raised above pronotum level; pronotum smooth; median carina continuous; prozonal carinae parallel; fastigium not narrow as *Coptotettix* (expanded), frontal ridge rounded, antennal groove at lower eye margin.

Composition.—The genus includes 50 valid species worldwide (Cigliano et al. 2025), 13 of which are reported from India (Chand et al. 2024) and a single species from Kerala. Three species—*H. gracilis, H. attenuatus* Hancock, 1904 and *H. lineifera* (Walker, 1871)—were recorded from the Kole wetlands during this study.

Hedotettix (cf.) *attenuatus* Hancock, 1904
Fig. 6A, B

Material examined.—INDIA • 1♂; Kerala, Thrissur, Konthipulam; 10.38566°N, 76.23761°E; 4 Sep. 2021; Thasnim E.S. leg.; CCSERLOKSFNI1 • 1♂; Kerala, Thrissur, Thommana; 10.34418°N, 76.25545°E; 5 Jul. 2021; Thasnim E.S. leg.; CCSERLO TJlFNI5.

Remarks.—Different from other species in having a narrow vertex compared to eye-width (Gupta et al. 2016).

Hedotettix gracilis (Haan, 1843)
Fig. 6E–H

Material examined.—INDIA • 1♂, 2♀; Kerala, Thrissur, Jubilee Thevarpadavu; 10.42243°N, 76.18025°E; 15 Sep. 2021; Thasnim E.S. leg.; CCSERLOJSFNI8, CCSERLOJSNI19, CCSERLOJSNI21 • 1♀; Kerala, Thrissur, Palakkal; 10.47874°N, 76.21322°E; 7 Jul. 2021; Thasnim E.S. leg.; CCSERLOPJlFNI3 • 2♂; Kerala, Malappuram; Srayilkadavu; 10.70082°N, 76.02652°E; 17 Nov. 2022; Thasnim E.S. leg.; CCSERLOSNFNII14, CCSERLOSNANII21.

Remarks.—Specimens examined morphologically differ in length of pronotum, body color, and shape but treated here as *H. gracilis* based on the presence of widely sulcate frontal costa (Kirby 1914, Gupta et al. 2016).

Hedotettix lineifera (Walker, 1871)
Fig. 6C, D

Material examined.—INDIA • 1♂; Kerala, Malappuram, Srayilkadavu; 10.70082°N, 76.02652°E; 17 Nov. 2022; Thasnim E.S. leg.; CCSERLOSNFNII11 • 1♂; Kerala, Malappuram, Uppungalkadavu; 10.69113°N, 76.00338°E; 12 Sep. 2021; Thasnim E.S. leg.; CCSERLOUSFNI4.

Remarks.—This species differs from other species in having four longitudinal white lines on the pronotum.

Genus *Tetrix* Latreille, 1802

Synonym.— *Acrydium* Geoffroy, 1762.
Acridium Schaeffer, 1766.
Acrydium Fabricius, 1775.
Acridium Schrank, 1801.
Tettix Berthold, 1827.
Tettis Kittary, 1849.
Tetix Caulfield, 1887.
Depressotetrix Karaman, 1960.
Macedotetrix Karaman, 1960.
Uvarovitettix Bazyluk & Kis, 1960.
Tetratetrix Karaman, 1965.
Bienkotetrix Kis & Vasiliu, 1970.

Type species.—*Gryllus subulatus* Linnaeus, 1758 (= *Tetrix subulata*), by subsequent designation

Taxonomic remarks.—Head slightly raised above pronotum level but not as in *Euparatettix* and *Ergatettix*; in lateral view, vertex produced in front of eyes in profile; in dorsal view, anterior margin of vertex straight, median carina raised, lateral carinae higher than compound eyes in frontal view, middle femora wider, antennae inserted at lower margin of compound eyes.

Composition.—The genus includes 141 species worldwide (Cigliano et al. 2025); three species were recorded in India (Chand et al. 2024), and the genus has not been reported from Kerala before now (Thasnim et al. 2023).

Tetrix (cf.) *arcunotus* Ingrisch, 2001
Fig. 7A, B

Materials examined.—INDIA • 1♂, 2♀; Kerala, Thrissur, Thommana; 10.34418°N, 76.25545°E; 16 Jan. 2021; Thasnim E.S. leg.; CCSERLOTJFNI7, CCSERLOTJANI20, CCSERLOTJANI21 • 1♂, 2♀; same collection data as for preceding; 9 Aug. 2021; CCSERLOTAuFNI4, CCSERLOTAuFNI6, CCSERLOTAuANI13 • 1♂; same collection data as for preceding; 5 Jul. 2021; CCSERLOTJlANI11 • 1♂; Kerala, Thrissur, Konthipulam; 10.38566°N, 76.23761°E; 22 Jan. 2021; Thasnim E.S. leg.; CCSERLOKJANI13 • 1♂; Kerala, Malappuram, Srayilkadavu; 10.70082°N, 76.02652°E; 9 Jul. 2021; Thasnim E.S. leg.; CCSERLOSJlANI20 • 1♂; same collection data as for preceding; 17 Nov. 2022; SERLOSNFNII12.

Remarks.—*T. arcunotus* shows morphological resemblance to *Paratettix cingalensis* (Walker, 1871), but it differs in the following characters: vertex wider than eye, protruding forward between eyes in lateral view, median carina of pronotum reaching anterior margin. *P. cingalensis* has vertex narrower than or equal to eye width, not protruding between eyes, median carina of pronotum not distinct at anterior margin (Tumbrinck 2015).

Discussion

We surveyed the Kole wetlands of Kerala for 3 years (2021–2024), and the collected specimens were identified into 12 morphospecies under 8 genera. Genera *Tetrix* and *Thoradonta* were reported for the first time from the state. The species *T. spiculoba, T. arcunotus, H. lineifera,* and *H. attenuatus* are new additions to Kerala as per published records (Thasnim et al. 2023).

So far, 22 species of pygmy grasshoppers have been reported from the state of Kerala (Thasnim et al. 2023). Compared to these data, 12 species reported from the study area represent a relatively high number. This includes 4 species that were new records for the state and some which were not identified to species level, suggesting the possibility of additional undocumented taxa.

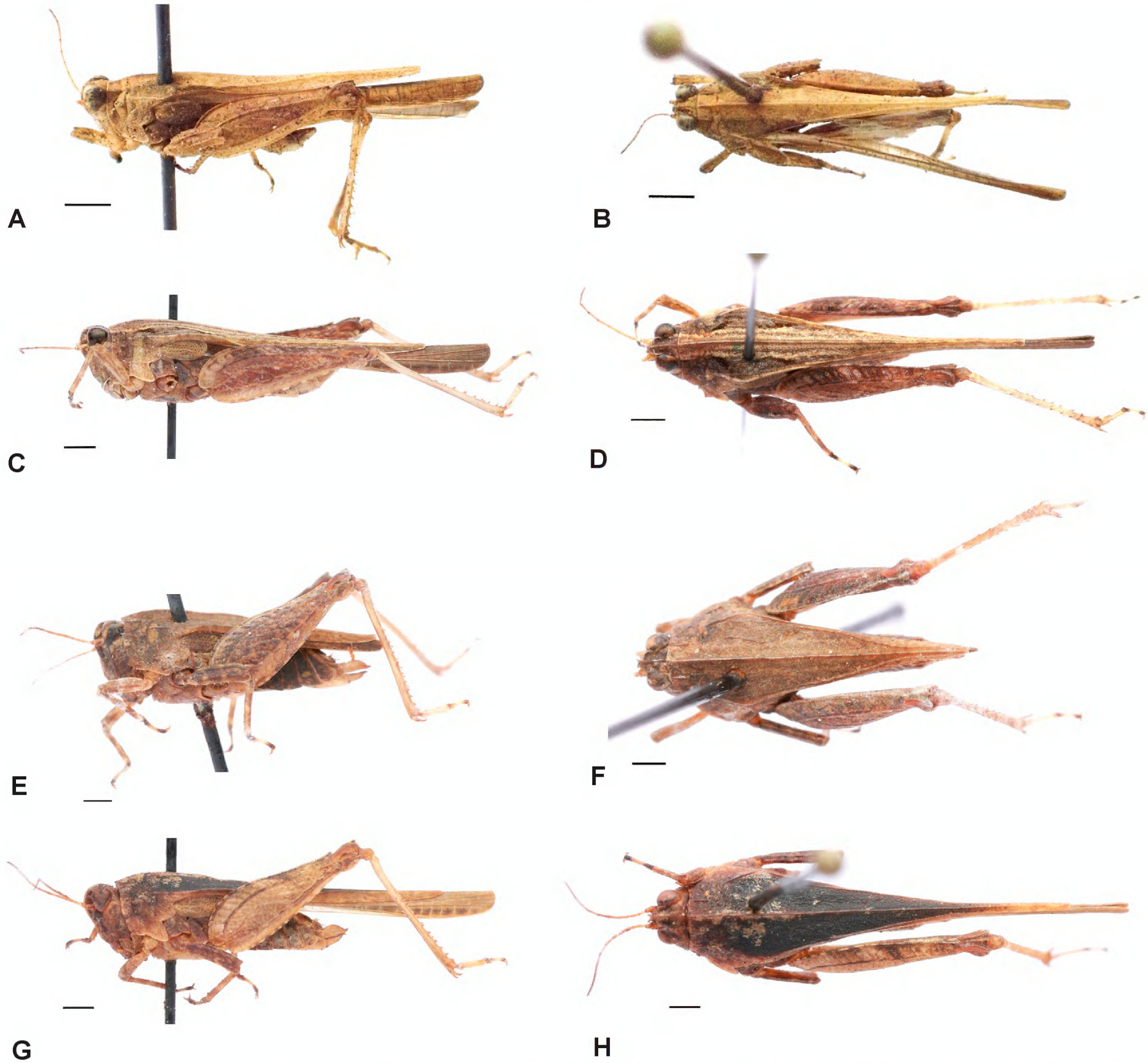

Fig. 6. Genus *Hedotettix* **A.** *Hedotettix (cf.) attenuatus*, lateral view; **B.** *Hedotettix (cf.) attenuatus*, dorsal view; **C.** *Hedotettix lineifera*, lateral view; **D.** *Hedotettix lineifera*, dorsal view; **E.** *Hedotettix gracilis*, morph 1, lateral view; **F.** *Hedotettix gracilis*, morph 1, dorsal view; **G.** *Hedotettix gracilis*, morph 2, lateral view; **H.** *Hedotettix gracilis*, morph 2, dorsal view. Scale bars: 1 mm.

However, the existing records may not fully reflect the true diversity of the state, as studies on Tetrigidae in Kerala are scarce. Bhaskar et al. (2019) recorded 9 species from Parambikulam Tiger Reserve and Eravikulam National Park, Bhaskar et al. (2020) described a new species from the Western Ghats of Kerala, and Mathew et al. (2022) recorded *Criotettix* and *Eucriotettix* from agroecosystems and grasslands located in the highlands and lowlands of Central Kerala.

The diversity observed in the Kole wetlands is slightly higher than that observed in similar studies conducted in other water-associated habitats. Neo et al. (2024) reported 9 species, under 7 genera from a freshwater swamp forest in Singapore, with 3 genera—*Coptotettix*, *Thoradonta*, and *Eucriotettix*—found in common. Subedi (2023) recorded 7 species, including a new species under 7 genera from the wetlands of Ramaroshan, Achham, Nepal, and 4 genera—*Coptotettix*, *Criotettix*, *Ergatettix*, and *Hedotettix*—overlapping with our findings. Subedi et al. (2024) recorded 11 species, including 5 new species from Shivapuri Nagarjuna National Park, Nepal, a habitat characterized by an elaborate network of freshwater streams and rivulets that create micro-localities and habitats suitable for hydrophilic organisms. Shishodia (1991b) recorded 15 species of pygmy grasshoppers under 9 genera from Maharashtra, India: He recorded species of the genus *Criotettix* near water bodies, *Eucriotettix* in marshy vegetation near torrential streams and waterfalls, and *Thoradonta* near perennial water bodies. These records emphasize the role of wetland ecosystems in supporting diverse Tetrigidae communities.

Fig. 7. *Tetrix* (cf.) *arcunotus* **A.** Lateral view; **B.** Dorsal view. Scale bars: 1 mm.

Other studies from various regions have also shown overlap with the genera recorded in the present study. Majeed et al. (2002) recorded 6 species under 5 genera from various localities of the Thal area of Punjab, Pakistan, with 3 genera—*Hedotettix*, *Euparatettix*, and *Ergatettix*—found in common. Shishodia (1991c) recorded 8 species, including *E. personatus*, *H.gracilis*, and *E. dorsiferus*, under 6 genera, including *Thoradonta*, *Criotettix*, and *Coptotettix*, from Kanha National Park, Mandla, Madhya Pradesh, all of which were also observed in our study area. Shishodia (2007) recorded 27 species from Mizoram. The species *H. gracilis*, *H. attenuatus*, *E. personatus*, *E. dorsiferus* and genera *Thoradonta*, *Eucriotettix*, and *Coptotettix* were found in common with the current study, highlighting considerable overlap despite ecological and geographic differences.

The genus *Coptotettix* was common across several studies (Shishodia 2007, Shishodia 1991b, c, Subedi 2023, Subedi et al. 2024, Neo et al. 2024). Neo et al. (2024) recorded a morphologically similar form of *Coptotettix* sp. 2 (Fig. 1C, D) from Nee Soon Swamp Forest, Singapore, suggesting a broader regional distribution of this taxon. The genera *Thoradonta*, *Criotettix*, *Eucriotettix*, *Ergatettix*, *Euparatettix*, and *Hedotettix* have also been reported from other water-associated habitats (Shishodia 1991b, Subedi 2023, Neo et al. 2024), and the species *E. personatus*, *E. dorsiferus*, and *H. gracilis* have been recorded in multiple studies (Shishodia 2007, Shishodia 1991b, c, Majeed et al. 2002, Bhaskar et al. 2019, Subedi 2023, Subedi et al. 2024). Shishodia (1991b) reported *E. personatus* and *E. dorsiferus* in marshy vegetation from Maharashtra. This indicates the diversity and distribution of Tetrigidae across varied habitats and the ecological significance of wetlands in supporting both common and locally specialized taxa.

Although *Euscelimena harpago* (Serville, 1838) is a widely distributed and commonly occurring species in India, which is present almost throughout the year near perennial freshwater bodies (Bhalerao and Paranjape 1993), it was not encountered in our study area. The Kole wetlands are low-lying, marshy wetland ecosystems that exhibit seasonal alterations in water levels. The species was previously recorded at a higher elevation in the state by one of the authors (Bhaskar et al. 2019), and the species records on iNaturalist also indicate its distribution at higher elevations. This suggests that its distribution may be confined to a specific altitudinal range and microhabitat.

Citizen science platforms such as iNaturalist can be used as valuable tools for biodiversity documentation (Skejo et al. 2020a, b). With significant observational data, these platforms can aid in understanding species distribution and seasonal patterns and uncover undocumented species. Citizen science platforms allow everyone to contribute, irrespective of age and profession, and make it easy to study global material and communicate with experts and citizen scientists alike (Skejo et al. 2020a).

On iNaturalist, 490 observations of pygmy grasshoppers are available for the Kerala region, representing 20 species, with expert confirmation available for 8. In the published literature (Thasnim et al. 2023), 22 species have been reported from the state. Despite the similar statistics, a closer examination reveals that some iNaturalist records are misidentified, and others lack expert confirmation. At the same time, it is interesting that the species *Xistrella stylata* (Hancock, 1907), recorded on iNaturalist from this region and identified by Dr. Josip Skejo, has not been reported in the state in the available literature. The species *Thoradonta spiculoba*, which also has no records from the state in the literature, has been recorded in the Kole wetlands, and its presence in other locations (Thrissur, Ernakulam, and Pathanamthitta) within Kerala is documented in iNaturalist, which supports its wider distribution in the state. This indicates the usefulness of the platform in revealing potentially new or unreported records.

In India, long-term monitoring projects are limited for many invertebrate groups, and platforms like iNaturalist can play a significant role in biodiversity monitoring. The platform has a record of 2102 observations of pygmy grasshoppers from the country. Access to smartphones and the internet in remote areas can contribute to the efficiency of capturing real-time data and, with the help of curious citizen scientists, can generate a useful, accessible database. However, such platforms also have limitations. Since the data is shaped by the interest and effort of individual users, it can be limited to accessible locations or visually striking species. Additionally, many observations are misidentified, and some are not identified. Thus, encouraging participation from a wider geographic range, including remote and under-surveyed areas, and the involvement of more taxonomic experts for verification are essential. It cannot replace detailed fieldwork but can assist in filling spatial gaps, uncovering new records, and promoting public participation in science. Thus, in tandem with field surveys, such platforms can be used to obtain a more complete picture of biodiversity.

In this study, identification of some specimens up to species level was difficult due to several factors. Based on the latest classification, the genus *Coptotettix* is placed separately under the family without being assigned to any tribes or subfamilies (Devriese et al. 2023, Cigliano et al. 2025). These inconsistent taxonomic placements suggest ongoing revisions and intricacies within the classification of this group.

The genera *Thoradonta* and *Eucriotettix* were placed under the tribe Thoradontini, and *Criotettix* under Criotettigini. These tribes were excluded from the subfamily Scelimeninae (Adžić et al. 2020) and placed separately without any subfamily. As per Subedi and Kasalo (2023), many of the species under these tribes do not fit completely with the genera under which they are assigned, and determining a set of valuable diagnostic characters for these genera is difficult; the similarities between *Criotettix* and *Eucriotettix*, even though they are placed in two separate tribes, add further complications.

Recently, Subedi et al. (2025) established a new subfamily, Criotettiginae Kevan, 1966, and placed the tribes Thoradontini and Criotettigini within it. Tumbrinck (in press, as cited in Subedi et al. 2025) demonstrated that the type species of *Eucriotettix* is morphologically indistinct from *Criotettix*, suggesting the synonymy of *Eucriotettix* with *Criotettix*, and many species currently placed in *Criotettix* should be assigned to *Acantholobus*. A detailed revision is necessary to resolve the taxonomic relationships among these genera.

The taxonomy of Tetrigidae is problematic, and there is a lack of clear diagnoses for many species. Many such diagnoses are based on characteristics such as pronotum length, body size, and color; as this group is well known for polymorphism, these characters are not dependable for distinguishing species. The specimens collected from the study area also exhibited variations in pronotum length, body size, color, and patterns on the pronotum. For example, the available keys for the genus *Thoradonta* (Zha et al. 2016, Gupta et al. 2018) were based on the pronotum length and ventro-lateral projections of the pronotum. However, some species under this genus were reported to be dimorphic in pronotum shape—brachypronotal and macropronotal—as in the case of *T. apiculata* reported in Thailand (Podgornaja 1994, Storozhenko and Dawwrueng 2015) and *T. spiculoba* from Vietnam (Podgornaya 1994). These characters also varied greatly in the specimens examined in this study. In addition, the specimens showed variations in the shape of the ventro-lateral projections of the pronotum. Thus, it was difficult to determine the species using the existing taxonomic keys. However, the specimens collected in the current study were identified as *T. spiculoba* based on their similarity to the species in terms of their very large ventro-lateral spines. *Thoradonta bengalensis* Shishodia, 1991a, described from India, may be a synonym of *T. spiculoba*.

Most of the earlier descriptions are vague and cannot be used to distinguish related genera. Genera such as *Hedotettix*, *Coptotettix*, *Euparatettix*, *Ergatettix*, and *Tetrix* are similar and not clearly separated (Skejo and Gupta 2015, Gupta 2016a). For example, a recent study of *Coptotettix* (Subedi 2022) suggested that the diagnostic characters provided in earlier studies for the genus were not applicable to all the species of the genus and that most are too broad and general to distinguish it from other related genera. Similarly, Skejo and Gupta (2015) suggested that *Hedotettix* does not possess strong diagnostic characters to differentiate it from other related genera.

Tetrigidae is a taxonomically complicated group with many species requiring clarification of their species boundaries and others awaiting discovery (Muhammed et al. 2018). When the specimens collected in the current study were compared with photos from taxonomic databases, images of all species were not available, and sometimes there were photos with variations under the same species.

We compared all the specimens to determine the differences that distinguish each species from the others collected from the Kole wetlands and identified up to species level with available resources. The diagnosis provided in this work is based purely on the collected specimens; it may not be applicable for all species of the genera. Since there are no further defining characters, the dichotomous key presented is based on comparing the collected specimens with the earlier literature, even though certain genera lack clear diagnostic features to distinguish them. Some specimens that were difficult to identify to the species level were tentatively grouped into different morphospecies based on morphological differences and are subject to further validation. More extensive taxonomic revisions and molecular studies are needed to clarify species boundaries.

This survey was the first step in documenting pygmy grasshoppers from the Kole wetlands of Kerala. They were mostly observed during monsoon and post-monsoon seasons. Pygmy grasshoppers are known to be limno-terrestrial, residing in semi-terrestrial habitats with intermittent periods of wetness and dryness, such as riverbanks and streams (Song 2019). The Kole wetlands provide a semi-terrestrial habitat and rich greenery during monsoon and post-monsoon seasons, which promotes the high diversity of these grasshoppers. During the study period, human intervention and other disturbances (such as the use of herbicides) were noticed. Further studies are needed to learn more about the ecology and impact of such disturbances on pygmy grasshoppers in the area.

There is no doubt that more studies, including molecular research, are needed to learn more about this interesting insect in this area. The current study can serve as a baseline for future research on the pygmy grasshoppers of the Kole wetlands of Kerala.

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